

ABSTRACT

A compact hydrogen generator is coupled to or integrated with a fuel cell for portable power applications. Hydrogen is produced via thermocatalytic decomposition (cracking, pyrolysis) of hydrocarbon fuels in oxidant-free environment. The apparatus can utilize a variety of hydrocarbon fuels, including natural gas, propane, gasoline, kerosene, diesel fuel, crude oil (including sulfurous fuels). The hydrogen-rich gas produced is free of carbon oxides or other reactive impurities, so it could be directly fed to any type of a fuel cell. The catalysts for hydrogen production in the apparatus are carbon-based or metal-based materials and doped, if necessary, with a sulfur-capturing agent. Additionally disclosed are two novel processes for the production of two types of carbon filaments, and a novel filamentous carbon product. The hydrogen generator can be conveniently integrated with high temperature fuel cells to produce an efficient and self-contained source of electrical power.